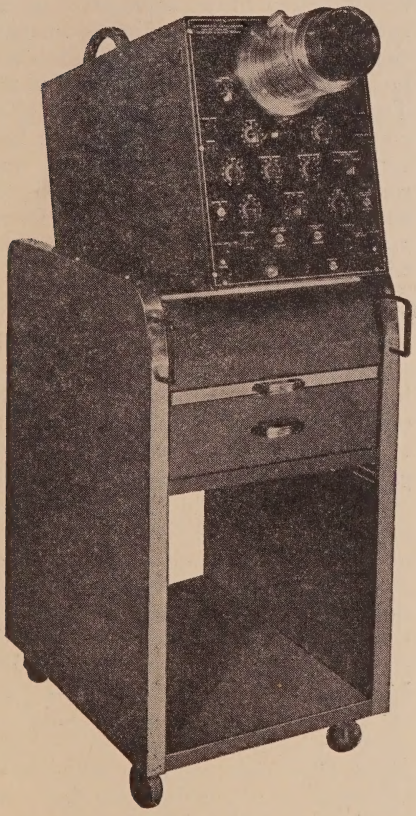
Vol. 8, No. 4 July-August, 1946

THE OSCILLOGRAPHER

Copyrighted and Published Bi-Monthly by the Allen B. Du Mont Laboratories, Inc., Passaic, New Jersey

A NEW OSCILLOGRAPH FOR RECORDING HIGH-SPEED TRANSIENTS

The Du Mont Type 247-A Employs The New Type 5RP Multiband Tube



The Du Mont Type 247-A Cathode-ray Oscillograph Equipped with the Type 2088 Projection Lens

Insufficient light output from the screen of a cathode-ray tube has proved to be a serious limitation on visual observation and photographic recording of high-speed transients. In the July-August, 1945 (Vol. 7, No. 4) issue of the Oscillographer,* the Type 5RP series of cathode-ray tubes was announced. These high-voltage intensifier types operate at a high ratio (10:1) of final intensifier-electrode voltage to second-anode voltage, which improves the observation of high-speed transients. In reply to many requests for an oscillograph incorporating the Type 5RP- cathode-ray tube, Du Mont has developed the Type 247-A which is a modification of the standard Type 247 oscillograph.

Essentially, the modification consists of the substitution of a Type 5RP- cathode-ray tube for the Type 5CP, the addition of a high-voltage connector and voltage-divider network to supply the intensifier electrodes of the 5RP-

* See also: Feldt, R. and Lempert, I. E., "The 5RP Multiband Tube: An Intensifier-Type Cathode-ray Tube for High-Voltage Operation," Proc. I.R.E., Vol. 34, page 432 (July, 1946).

CONTENTS

A New Oscillograph For Recording High-Speed Transients
The Du Mont Type 263-A High-Voltage Power Supply
The Du Mont Type 274 Cathode-ray Oscillograph
Notes On Attenuator Distortion

and the mechanical changes required to properly support and shield the new tube. The Du Mont Type 263-A High-Voltage Power Supply is specified as standard equipment to furnish the high voltage.

The Type 263-A is a radio-frequency power supply. It provides a continuously variable d-c output voltage from 5 to 10 kv with a regulation of 20% from no load to a 200 microampere load.

Quantitative comparisons of maximum writing rates recorded on the Type 247 and the Type 247-A have been made. With the Type 247 employing a Type 5CP11 it is possible to record writing rates up to 5.5 km/sec (0.2 in./μsec) with a camera employing an f/3.5 lens and image reduction of 5:1. Using the Type 247-A, writing rates up to 50 km/sec (2 in./μsec) can be recorded with an f/3.5 lens. Thus, the Type 247-A permits recording writing rates that are ten times higher than can be recorded with the Type 247 oscillograph. Use of an f/1 (faster) lens would further increase the maximum writing rate, by a factor of 12, to 600 km/sec (24 in./μsec).

The increased light output of the Type 5RP- and the addition of a lens suggests the possibility of further modification to a projection oscillograph. Equipped with a Du Mont Type 2088 Projection Lens, soon to be available as an accessory, the Type 247-A is an ideal instrument for lecture or demonstration purposes.

Facilities for the modification of the Type 247 cathode-ray oscillograph will be provided for at the factory. It is only necessary to contact the National Service Department by a letter of intent and a request for shipping instructions. The cost of the modification will be $432.50; this includes the cost of the Type 5RP tube and the Type 263-A power supply. Before leaving the factory, the instrument is cleaned and minor repairs are performed wherever necessary. After a thorough performance check, the instrument is returned with a new guarantee.

THE DU MONT TYPE 263-A HIGH-VOLTAGE POWER SUPPLY

Type 263-A High-Voltage Power Supply

The Du Mont Type 263-A High-Voltage Power Supply is designed primarily for use as an accessory with cathode-ray oscillographs. It serves to extend their usefulness by providing higher accelerating potentials than are usually self-contained. The application of a high accelerating potential to the cathode-ray tube produces an intense pattern which is very desirable for photographic or projection purposes.

Unfortunately, the intensifier voltage of standard cathode-ray tubes cannot be increased much above a ratio of 2:1 with respect to the second anode voltage, without producing serious pattern distortion. This difficulty has been overcome by the creation of the Du Mont Type 5RP- multiband cathode-ray tube, which allows ratios as high as 10:1 without distortion. The Type 263-A High-Voltage Power Supply may be employed to supply intensifier voltage in any application where a Type 5RP- tube is used.

In addition to this application, the Type 263-A will be found useful wherever a portable, rugged and safe high-voltage supply of small current capability is needed.

Description

The Type 263-A is a radio-frequency power supply. It provides a d-c voltage output which is continuously variable from 5,000 to 10,000 volts with loads up to 200 microamperes.

The instrument is more compact and much lighter than a comparable 60 cycle supply, and is so designed that inexperienced personnel may handle it with safety. Rugged mechanical construction is employed to permit field or laboratory use. A carrying handle and a bracket for winding up the power and output cables are provided on the cabinet.

The instrument consists of a radio-frequency oscillator with its power supply, an r-f step-up transformer, a half-wave rectifier, and a high-voltage filtering and metering system. Upon the front panel is mounted an output kilovoltmeter with a scale calibrated from 0 to 10 kv, an output connector, a control for varying the output, pilot light, fuse, and power switch. A four-foot length of shielded output cable and connector is furnished with the unit.

Specifications

Electrical Specifications

Output Voltage Range (at currents to 200 microamperes)..5 to 10 kv. (Output voltage is positive with respect to ground, negative terminal is connected to chassis.)

Regulation

Within 20% from no load to a 200 microampere load.

Ripple Voltage.....less than 0.5%

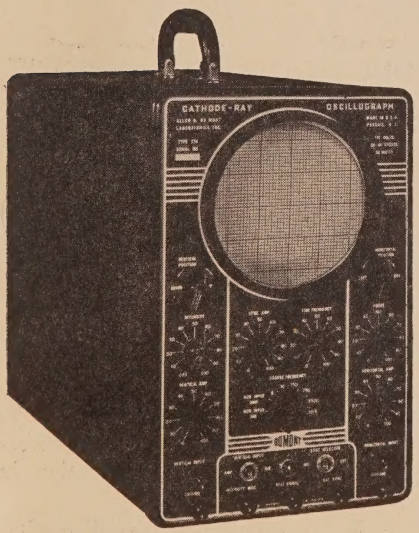
Power Supply

Voltage	115 volts
Frequency	50-60 cps
Power Consumption	100 watts

Physical Specifications

Height	10⅞ inches
Width	8⅛ inches
Depth	14¾ inches
Weight	24 pounds

THE DU MONT TYPE 274 CATHODE-RAY OSCILLOGRAPH



Type 274 Cathode-ray Oscillograph

The Du Mont Type 274 Cathode-ray Oscillograph was developed to supply the demand for an inexpensive five-inch laboratory oscillograph. Although of economical design and construction, the Type 274 meets the high standards of quality and performance that is characteristic of laboratory equipment.

A Type 5BP1A cathode-ray tube is employed in the Type 274. Its improved gun structure permits operation with negligible focusing-electrode current.

The vertical and horizontal deflection amplifiers are identical; each uses a Type 6SJ7. Frequency response of these amplifiers is uniform within 20% from 20 cps to 50 kc, and down not more than 50% at 100 kc. Signals having frequencies outside the limits of the amplifiers may be observed by applying them directly to the deflection plates. The deflection factor for both X- and Y-axis deflection is 0.65 volt (rms) per inch when the deflection-voltage amplifiers are used. The deflection factor for

the Type 5BP1A cathode-ray tube is 18 volts (rms) per inch for both axes.

A Type 884 gas triode is employed in the sweep circuit to provide a linear time base with a frequency range from 8 cps to 30 kc. It is possible to synchronize the time-base generator with either the Y-axis signal or an external signal.

The utility of the Type 274 has been increased by including a provision for intensity modulation of the cathode-ray beam. A Z-axis input terminal on the panel is capacitively coupled to the grid of the Type 5BP1A.

The Operating and Maintenance Manual for the Type 274 deserves special mention. In addition to the operating and maintenance instructions, the manual includes step-by-step procedures for the alignment and trouble shooting of radio transmitters and receivers with the aid of an oscillograph. Also included in this manual is a section on the theory of operation of the cathode-ray tube and its associated circuits.

Rugged mechanical construction is employed to permit field or laboratory use. A carrying handle and a bracket for winding up the power cable are provided on the cabinet. A removable, calibrated scale is furnished to provide a convenient means for measuring deflection and comparing oscillograms.

The instrument measures 14" high by 8⅝" wide by 19⅜" deep and weighs 35 lb.

Power Supply

A self-contained power supply operates from a source of 115 volts, 50-60 cycles per second; power consumption is 50 watts.

For convenience, a socket is provided on the rear of the chassis for supplying filament and plate voltage for the operation of associated equipment. It can furnish 6.3 volts at 1.8 amperes and 400 volts at 16 milliamperes.

NOTES ON ATTENUATOR DISTORTION

Compensated stepped attenuators such as those used in the input circuits of cathode-ray oscillographs often cause distortion of square-wave test signals. This distortion, shown in Figure 1, is only noticeable at medium frequencies. At higher and lower frequencies, the response of the amplifiers may alter the trace slightly and obscure the attenuator distortion.

Such distortion appears at the leading edge of the square wave and cannot be corrected by over-compensation, that is, by an increase in capacitance of C1 shown in Figure 2. Investigation revealed that such distortion was due to a lagging voltage-coefficient of resistivity of the carbon resistor R1, and could be eliminated by replacing R1 with a metallized-filament type resistor.

The decrease in resistance as the applied voltage increases does not occur instantaneously, but requires approximately 10 microseconds for ordinary carbon resistors, and about one-tenth this time for the metallized types. Checks indicated that this lagging voltage-coefficient of resistivity is exhibited by many types of resistors; among the products of different manufacturers there exists considerable variation in this characteristic.

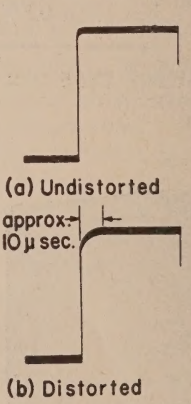


FIGURE 1
Attenuated 10 kc Square Wave

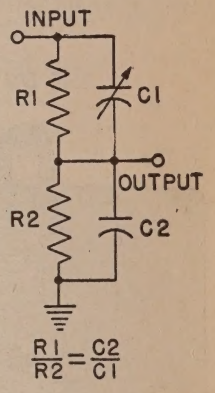


FIGURE 2
Typical Compensated Attenuator

It is suggested that metallized-filament type resistors, which have a small lagging voltage-coefficient of resistivity, be used in compensated stepped attenuator units.